Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

1.(currently amended) A method comprising:

creating a communications line with two or more twisted copper pairs of wire in one or more binders;

~~coordinating physical-layer signals across two or more receivers; and~~

~~coordinating the physical-layer signals across two or more transmitters~~

receiving from said two or more twisted pairs across two or more receivers physical layer signals that have been coordinated across two or more transmitters; and

exploiting a correlation between measured interference noise values across two or more of said receivers to reduce interference noise in the physical layer signals.

2. (original) The method of claim 1, further comprising minimizing interference noise on the communications line from external sources.

3. (original) The method of 2, wherein the interference noise includes crosstalk noise from high-bitrate services in the one or more binders.

Claim 4 (canceled)

5. (currently amended) The method of claim [[4]] 1, wherein the two or more receivers and two or more transmitters utilize a Discrete Multi-Tone architecture having one or more frequency bins.

6. (currently amended) The method of claim 5, wherein ~~coordinating~~ receiving physical-layer signals across two or more receivers is performed in a frequency domain, independently for each frequency bin of the one or more frequency bins.

7. (currently amended) The method of claim 5, wherein ~~coordinating~~ the physical-layer signals coordinated across two or more transmitters ~~is performed~~ include signals coordinated in a frequency domain, independently for each frequency bin of the one or more frequency bins.

8. (currently amended) The method of claim 6, wherein ~~coordinating~~ receiving physical-layer signals across two or more receivers comprises:

multiplying a transmitted symbol vector, whose elements are one or more individual symbols intended for each of the one or more transmitters, with a MIMO (Multiple Input Multiple Output) pre-processing matrix, to generate multiplied transmitted vectors;

sending the multiplied transmitted vectors to an IFFT (Inverse Fast Fourier Transform) for conversion into time-domain waveforms;

converting a received symbol vector into frequency-domain symbols via a FFT (Fast Fourier Transform); and

multiplying the frequency domain symbols with a MIMO post-processing matrix.

9. (original) The method of claim 8, further comprising maximizing a SNR (Signal-to-Noise Ratio) in each frequency bin of the one or more frequency bins across the communications line, wherein the MIMO pre-processing matrix and the MIMO post-processing matrix are designed separately for each frequency bin of the one or more frequency bins.

10. (original) The method of claim 9, further comprising designing the MIMO post-processing matrix used in each frequency bin of the one or more frequency bins to perform

pre-whitening the interference noise across the communications line, and

acting as a matrix FEQ (Frequency EQualizer) to equalize effects of a shortened multiline communications channel on the transmitted symbol vector.

11. (original) The method of claim 10, wherein pre-whitening further comprises:

restricting the interference noise onto a subspace of a smallest possible dimension in a signal space; and

providing one or more independent directions in the signal space to be free of interference noise.

12. (original) The method of claim 11, further comprising designing the MIMO pre-processing matrix used in each frequency bin of the one or more frequency bins to

be Hermitian, so that a transmitted signal power across the two or more twisted copper pairs is preserved; and

yield an identity matrix when pre-multiplied by a main channel transfer matrix for a same frequency bin of the one or more frequency bins and the MIMO post-processing matrix for the same frequency bin of the one or more frequency bins.

13. (currently amended) A system comprising:

means for creating a communications line with two or more twisted copper pairs of wire in one or more binders;

means for ~~coordinating physical-layer signals across two or more receivers~~ receiving from said two or more twisted pairs across two or more receivers physical layer signals that have been coordinated across two or more transmitters; and

means for ~~coordinating the physical-layer signals across two or more transmitters~~ exploiting a correlation between measured interference noise values across two or more of said receivers to reduce interference noise in the physical layer signals.

14. (original) The system of claim 13, further comprising means for minimizing interference noise on the communications line from external sources.

15. (original) The system of claim 14, wherein the interference noise includes crosstalk noise from high-bitrate services in the one or more binders.

Claim 16 (canceled)

17. (currently amended) The system of claim [[16]] 12, wherein the two or more receivers and two or more transmitters utilize a Discrete Multi-Tone architecture having one or more frequency bins.

18. (currently amended) The system of claim 17, wherein means for ~~coordinating~~ receiving physical-layer signals across two or more receivers is performed in a frequency domain, independently for each frequency bin of the one or more frequency bins.

19. (currently amended) The system of claim 17, wherein ~~coordinating~~ the physical-layer signals coordinated across two or more transmitters ~~is performed~~ includes signals coordinated in a frequency domain, independently for each frequency bin of the one or more frequency bins.

20. (currently amended) The system of claim 18, wherein means for ~~coordinating~~ receiving physical-layer signals across two or more receivers comprises:

means for multiplying a transmitted symbol vector, whose elements are one or more individual symbols intended for each of the one or more transmitters, with a MIMO (Multiple Input Multiple Output) pre-processing matrix, to generate multiplied transmitted vectors;

means for sending the multiplied transmitted vectors to an IFFT (Inverse Fast Fourier Transform) for conversion into time-domain waveforms;

means for converting a received symbol vector into frequency-domain symbols via a FFT (Fast Fourier Transform); and

means for multiplying the frequency domain symbols with a MIMO post-processing mix.

21. (original) The system of claim 20, further comprising means for maximizing a SNR (Signal-to-Noise Ratio) in each frequency bin of the one or more frequency bins across the communications line, wherein the MIMO pre-processing matrix and the MIMO post-processing matrix are designed separately for each frequency bin of the one or more frequency bins.

22. (original) The system of claim 21, further comprising means for designing the MIMO post-processing matrix used in each frequency bin of the one or more frequency bins to perform

pre-whitening the interference noise across the communications line, and

acting as a matrix FEQ (Frequency EQualizer) to equalize effects of a shortened multiline communications channel on the transmitted symbol vector.

23. (original) The system of claim 22, wherein means for pre-whitening further comprises:

means for restricting the interference noise onto a subspace of a smallest possible dimension in a signal space; and

means for providing one or more independent directions in the signal space to be free of interference nosie.

24. (original) The system of claim 23, further comprising means for designing the MIMO pre-processing matrix used in each frequency bin of the one or more frequency bins to

be Hermitian, so that a transmitted signal power across the two or more twisted copper pairs is preserved; and

yield an identity matrix when pre-multiplied by a main channel transfer matrix for a same frequency bin of the one or more frequency bins and the MIMO post-processing matrix for the same frequency bin of the one or more frequency bins.

25. (currently amended) A computer readable medium, having stored thereon computer-readable instructions, which when executed in a computer system, cause the computer system to

create a communications line with two or more twisted copper pairs of wire in one or more binders;

receive from said two or more twisted pairs across two or more receivers physical layer signals that have been coordinated across two or more transmitters; and

exploit a correlation between measured interference noise values across two or more of said receivers to reduce interference noise in the physical layer signals.

~~coordinate physical-layer signals across two or more receivers; and~~

~~coordinate the physical-layer signals across two or more transmitters~~.

26. (original) The computer readable medium of claim 25, further having stored thereon computer-readable instructions, which when executed in the computer system, cause the computer system to minimize interference noise on the communications line from external sources.

27. (original) The computer readable medium of claim 26, wherein the interference noise includes crosstalk noise from high-bitrate services in the one or more binders.

Claim 28 (canceled)

29. (currently amended) The computer readable medium of claim [[28]] 25, wherein the two or more receivers and two or more transmitters utilize a Discrete Multi-Tone architecture having one or more frequency bins.

30. (currently amended) The computer readable medium of claim 29, wherein ~~coordinating~~ receiving physical-layer signals across two or more receivers is performed in a frequency domain, independently for each frequency bin of the one or more frequency bins.

31. (currently amended) The computer readable medium of claim 29, wherein ~~coordinating~~ the physical-layer signals coordinated across two or more transmitters ~~is performed~~ includes signals coordinated in a frequency domain, independently for each frequency bin of the one or more frequency bins.

32. (currently amended) The computer readable medium of claim 30, further having stored thereon computer-readable instructions, which when executed in the computer system to ~~coordinate~~ receive physical-layer signals across two or more receivers, cause the computer system to:

multiply a transmitted symbol vector, whose elements are one or more individual symbols intended for each of the one or more transmitters, with a MIMO (Multiple Input Multiple Output) pre-processing matrix, to generate multiplied transmitted vectors;

send the multiplied transmitted vectors to an IFFT (Inverse Fast Fourier Transform) for conversion into time-domain waveforms;

convert a received symbol vector into frequency-domain symbols via a FFT (Fast Fourier Transform); and

multiply the frequency domain symbols with a MIMO post-processing matrix.

33. (original) The computer readable medium of claim 32, further having stored thereon computer-readable instructions, which when executed in the computer system, cause the computer system to maximize a SNR (Signal-to Noise Ratio) in each frequency bin of the one or more frequency bins across the communications line, wherein the MIMO pre-processing matrix and the MIMO post-processing matrix are designed separately for each frequency bin of the one or more frequency bins.

34. (original) The computer readable medium of claim 33, further having stored thereon computer-readable instruction, which when executed in the computer system, cause the computer system to design the MIMO post-processing matrix used in each frequency bin of the one or more frequency bins to:

pre-whiten the interference noise across the communications line, and

act as a matrix FEQ (Frequency EQualizer) to equalize effects of a shortened multiline communications channel on the transmitted symbol vector.

35. (original) The computer readable medium of claim 34, further having stored thereon computer-readable instructions, which when executed in the computer system to pre-whiten the interference noise, cause the computer system to:

restrict the interference noise onto a subspace of a smallest possible dimension in a signal space; and

provide one or more independent directions in the signal space to be free of interference noise.

36. (original) The computer readable medium of claim 35, further having stored thereon computer-readable instructions, which when executed in the computer system, cause the computer system to:

design the MIMO pre-processing matrix used in each frequency bin of the one or more frequency bins to

be Hermitian, so that a transmitted signal power across the two or more twisted copper pairs is preserved; and

yield an identity matrix when pre-multiplied by a main channel transfer matrix for a same frequency bin of the one or more frequency bins in the MIMO post-processing matrix for the same frequency bin of the one or more frequency bins.

37. (currently amended) A system comprising:

a communications line with two or more twisted copper pairs of wire in one or more binders;

two or more receivers coupled to the communications line;

two or more transmitters coupled to the communications line;~~ and~~

physical-layer signals coordinated across the two or more twisted copper pairs of wire by the two or more transmitters and received from said two or more copper pairs across the two or more receivers; and

the two or more receivers reducing interference noise by exploiting a correlation between measured interference noise values across the two or more receivers.

38. (original) The system of claim 37, wherein the two or more receivers and two or more transmitters minimize interference noise on the communications line from external sources.

39. (original) The system of claim 38, wherein the interference noise includes crosstalk noise from high-bitrate services in the one or more binders.

Claim 40 (canceled)

41. (currently amended) The system of claim [[40]] 37, wherein the two or more receivers and two or more transmitters utilize a Discrete Multi-Tone architecture having one or more frequency bins.

42. (currently amended) The system of claim 41, wherein the physical-layer signals are ~~coordinated~~ received in a frequency domain, independently for each frequency bin of the one or more frequency bins.

43. (original) The system of claim 42, wherein the two or more receivers:

multiply a transmitted symbol vector, whose elements are one or more individual symbols intended for each of the one or more transmitters, with a MI O (Multiple Input Multiple Output) pre-processing matrix, to generate multiplied transmitted vectors;

send the multiplied transmitted vectors to an IFFT (Inverse Fast Fourier Transform) for conversion into time-domain waveforms;

convert a received symbol vector into frequency-domain symbols via a FFT (Fast Fourier Transform); and

multiply the frequency domain symbols with a MIMO post-processing matrix.

44. (original) The system of claim 43, wherein the two or more receivers maximize a SNR (Signal-to-Noise Ratio) in each frequency bin of the one or more frequency bins across the communications line, wherein the MMO pre-processing matrix and the MJMO post-processing matrix are designed separately for each frequency bin of the one or more frequency bins.

45. (original) The system of claim 44, wherein the MIMO post-processing matrix used in each frequency bin of the one or more frequency bins pre-whiten the interference noise across the communications line, and act as a matrix FEQ (Frequency EQualizer) to equalize effects of a shortened multiline communications channel on the transmitted symbol vector.

46. (original) The system of claim 45, wherein the two or more receivers restrict the interference noise onto a subspace of a smallest possible dimension in a signal space; and

provide one or more independent directions in the signal space to be free of interference noise.

47. (original) The system of claim 46, wherein the MIMO pre-processing matrix used in each frequency bin of the one or more frequency bins are Hermitian, so that a transmitted signal power across the two or more twisted copper pairs is preserved; and

yield an identity matrix when pre-multiplied by a main channel transfer matrix for a same frequency bin of the one or more frequency bins and the MIMO post-processing matrix for the same frequency bin of the one or more frequency bins.